reliability greater than 0.9, the following approximation is frequently used

$$e^{-\lambda t} \approx 1-\lambda t$$

where a system consist of n elements in parallel, and each of these elements can by itself satisfy the requirements, the parallel (or redundant)reliability, RP, is given by

$$R_P = 1 - \prod_{i}^{n} (1 - R_i)$$

where the reliability of the parallel elements is equal, say Rn, the above simplifies to

$$R_p = 1-(1-R_a\lambda)^n$$

[0062] In terrestrial applications it is customary to distinguish between active and quiescent (dormant) failure rates, the latter being about one-tenth of the active rates. The reduction accounts for the absence of electrical stress when a component is not energized. However, the high reliability requirements of the space environment cause components to be derated so the failure probability due to electrical stresses even in the active mode is quite small. The distinction between active and quiescent failure rates in therefore much less important for spacecraft applications. Design life, the intended operational time on orbit is an important parameter for the reliability program. It determines the amount of consumables that must be provided and establishes quality and test reliability calculated at the designing life and the mission success probability. The first measure of reliability, the expected life defined as the mean mission duration or MMD, given by:

$$MMD = \int T dR$$

where T represents (time) and dR is increment in reliability. MMD is a frequently used figure of merit for spacecraft reliability improvement programs. The second measure of reliability is the limiting availability, A, given by

$$A = \lim_{t \to \infty} A(t)$$

Regardless of the probability distribution the limiting availability is often easy to obtain.

$$A = \frac{E(T_i)}{E(T_i) + E(D_i)} = \frac{MTTF}{MTTF + MTTR}$$

Suppose T_i is an exponential random variable having failure rate λ and D_i is an exponential random variable having repair rate μ then.

$$A(t) = \frac{\mu}{\lambda + \mu} + \frac{\lambda}{\lambda + \mu} e^{-(\lambda+\mu)t}$$

where for a long period of time, $t \to \infty$, system availability is given by

$$A = \frac{\mu}{\lambda + \mu}$$

The system availability for a system comprised of independent components is given by $A=A_1A_{23}$ where A_1 is the availability of components 1 and A_{23} is the system availability of two components 2 and 3 defined by,

$$A_{23} = 1-1(1-A_2)(1-A_3)$$

Benefits

[0063] The benefits realized through this manufacturing in space vision are significant. The immediate benefit is the in situ repair and fabrication "machine shop" in space for making components and systems. Such a facility can be a key component in saving lives and/or providing a greater opportunity for survivability for astronauts, and space travelers during a mission. Through this concept of manufacturing in space, very large scale space structures call be built thus reducing the cost for launch of such structures.

[0064] The SMMU model and its flexible platform can be configured into various research facilities such as a surgical unit, a biological research unit, or a material science laboratory leading researchers toward improving the quality of life for mankind.

[0065] Such SMMU can be used as a space port and a critical means in helping to colonize the space for future exploration.

What is claimed is:

1. A system for manufacturing in space comprising:

a first spaced based module allowing human habitation;

a control system in said first space based module;

a second spaced based module joined to said first spaced based module;

a robotic device in said second space based module controlled at least in part by said control system;

at least one manufacturing tool in said second spaced based module controlled at least in part by said control system;

a communication network connecting said first spaced based module to an earth based communication center;

an earth based means for designing and engineering a structure to be manufactured, generated design and engineering data communicated to said control system; and

a spaced based means to perform safety checks prior to initiation of manufacturing operations.

2. The system of claim 1, wherein said second space based module includes a floor slideable into said second module.

3. The system of claim 2, wherein a floor of said second space based module includes floor rollers.

4. The system of claim 1, wherein said first space based module has a means for visually monitoring an interior of said second space based module.

5. The system of claim 4, wherein said means for visually monotiring includes video cameras.